

Application of Information Theory, Introduction

Iftach Haitner

Tel Aviv University.

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Section 1

Administration

Important Details

1. Iftach Haitner. Schriber 20, email [iftachh at gmail.com](mailto:iftachh@gmail.com)
Reception: **Sundays 09:30-10:30** (please coordinate via email **in advance**)

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2. Who are you?
3. Mailing list: 0368-4486-01@listserv.tau.ac.il

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subscribe 0368-4486-01 <Real Name>

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listserv@listserv.tau.ac.il with the line:
subscribe 0368-4486-01 <Real Name>
4. Course website:
[.../~iftachh/Courses/Info/Spring18/index.html](http://~iftachh/Courses/Info/Spring18/index.html)
(or just Google **iftach** and follow the link)

Grades

1. Class exam 80%

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2. Homework 20%: 5-6 exercises.

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 - ▶ Recommended to use \LaTeX (see link in course website)
 - ▶ Exercises should be sent to ? or put in mailbox ?, **in time!**

and..

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2. English

Section 2

Information Theory

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- ▶ An amazing example of an amazing research done by mainly by asking the right questions.

Section 3

The Course

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Information Theory is typically taught in EE. In this course we will focus on the point of view of CS and Math, and less on EE applications.

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- ▶ Axiomatic derivation of Shannon's entropy
- ▶ Conditional entropy and mutual information
- ▶ Relative entropy (Kullback-Leibler information)
- ▶ Entropy of a continuous random variable
- ▶ The maximum entropy principle
- ▶ Huffman coding
- ▶ The asymptotic equipartition theorem
- ▶ Data compression
- ▶ Channel capacity
- ▶ Shearer's inequality
- ▶ Applications to combinatorics
- ▶ Kolmogorov complexity

Course Topics cont.

Second part of the course will focus on computational notions of entropy.

Course Topics cont.

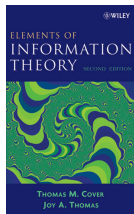
Second part of the course will focus on computational notions of entropy.

- ▶ Parallel repetition of interactive argument
- ▶ Extractors and Hardcore predicates
- ▶ Pseudo entropy and pseudorandom generators
- ▶ Accessible entropy and statistically hiding commitments

Material

- ▶ Books:

Thomas Cover & Joy Thomas: Elements of Information Theory.



- ▶ Papers:

- ▶ Jaikumar Radhakrishnan: Entropy and Counting.

- ▶ Lecture notes:

- ▶ Yury Polyanskiy and Yihong Wu.
 - ▶ Anup Rao.
 - ▶ Venkatesan Guruswami and Mahdi Cheraghchi.

Prerequisites

Basic probability and calculus.